4.0 ENVIRONMENTAL CONSEQUENCES

4.1 AIR QUALITY

This section provides a discussion of the air quality impacts associated with the no-action and proposed alternatives. It addresses both direct and indirect effects and discusses their impacts relative to the inventory of air emissions for the Houston-Galveston Nonattainment Area. As discussed in Section 3.1, for air quality monitoring and planning purposes, the EPA relies on the designation of nonattainment areas for air pollutants within the boundaries of geographical planning units. For consistency with the EPA's designations, the HGA, designated as a non-attainment area by the EPA, was selected as the appropriate area for consideration of the potential air quality impacts of the proposed alternatives.

The evaluation of impacts to air quality associated with the alternatives was based on the identification of air contaminants and estimated emission rates. The air contaminants considered are those covered by the NAAQS (except for lead (Pb), which is not relevant to project emissions) including carbon monoxide (CO), ozone (O_3), nitrogen oxide (NO_X), particulate matter with diameters less than 10 microns (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and sulfur dioxides (SO_X). Air emissions were considered for channel widening activities and placement of dredged material as well as emissions from vehicular traffic associated with the project employee commute. Project emissions were estimated based on preliminary assumptions provided by the project sponsors. It is not within the scope of this analysis to perform the refined dispersion modeling necessary to predict concentrations for each contaminant and alternative. Rather, the impact of emissions was analyzed relative to the existing inventory and monitored data for air contaminant emissions in the HGA nonattainment area.

The estimated air contaminant emissions, except O_3 and its precursors, were compared to the 2001 emissions inventory for the HGA. Assuming an increase in air emissions will result in a corresponding increase in the ambient air concentration for that air contaminant, the ratio of the estimated emissions to the existing 2001 emissions for that contaminant provided a relative indication of the potential increase in ambient concentrations for the air contaminant. That difference was then compared to the NAAQS. As shown in Table 3.1-4 in Section 3.1, monitored values suggest that concentrations of air contaminants (except O_3) for this area are well below the NAAQS and even appear to be on the decline over the years for which monitored values are available. Because air emissions are generally dispersed with distance and time, a relatively small increase in emissions may be assumed to cause a correspondingly small increase in ambient air quality concentrations for that air contaminant, and it is therefore, expected that the increase in emissions will not cause an exceedance of the NAAQS.

As discussed in Section 3.1, the CAA, under 42 U.S.C. 7506(c) (1), prohibits Federal agencies from funding, permitting, or licensing any project that does not conform to an applicable SIP. The purpose of this General Conformity requirement is to ensure Federal agencies consult with state and local air quality districts to assure these regulatory entities know about the expected impacts of the Federal action and can include expected emissions in their SIP emissions budget. The conformity requirements were

promulgated to ensure attainment and maintenance of the NAAQS and to ensure that Federal actions will not cause or contribute to new violations of the NAAQS. Because permitting for the project is considered a Federal Action, emissions were also considered in terms of the General Conformity rules.

4.1.1 Alternative 1: No-Action

No construction or new operating emission sources are associated with the No-Action alternative. However, it is expected that air contaminant emissions will increase due to continued operational constraints on the existing system and projected increased ship traffic resulting both from growth of existing business and from new business at the Port.

4.1.2 Alternative 2: Proposed Action with Placement at Quintana

The evaluation of air quality impacts associated with Alternative 2 was based on the identification of air contaminants and estimated emission rates for this project alternative. Emissions inventories were estimated for project-related activities based on the schedule, equipment use, capacity, and other related assumptions provided by the project sponsors. Detailed emissions estimates are contained in the reference document (PBS&J, 2006).

The emission sources will consist of harbor vessels and land-based mobile sources that will be utilized during the channel widening activities, as follows:

- Harbor Vessels – includes dredges (cutterhead, bucket crane, and hopper) and support equipment (tugboats, runabouts, and tenders), and shrimp trawlers
- Land-based – include off-road (bulldozers) and on-road (employee vehicles)

Air contaminant emissions associated with the channel widening would be primarily combustion products from fuel burned in equipment used for project dredging, support, vessels, and dredged material reuse equipment. Activities at dredged material reuse/placement sites would involve the use of earth-moving equipment such as bulldozers. The harbor vessel emission sources will be primarily diesel-powered engines. The off-road equipment was assumed to be all diesel-powered and the on-road vehicles all gasoline-powered vehicles.

4.1.2.1 Methods Used for Estimation of Air Contaminant Emissions

The primary air contaminant emissions from this project would be from dredging activities, emissions from the equipment used for beach placement, and secondary emissions resulting from employee vehicular traffic. The basis for emissions included the following:

- Preliminary project description and other information, as provided by the project sponsor.
- Emissions from harbor vessels in support of the dredging activities were estimated for the years 2007 and 2008, as the project is expected to begin in the fourth quarter of 2007 with an expected duration of not more than one year. The basis for emissions estimates consisted of the operating

hours for each specific type of equipment engine, engine load factor, and engine horsepower. Emission rates (tons per hour) from dredges, dredging support equipment, and other harbor vessels were calculated for each criteria pollutant and were derived based on the following formula:

*Emission Rate = Engine Horsepower * Engine Load Factor * Emission Factor*

Load factors and emission factors for the different marine equipment were determined based on the EPA report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data," February 2000. Emission amounts (tpy) for each of the pollutants were then calculated based on the following formula:

*Emission Amount (tons/year) = Emission Rate (tons/hr) * Working Hours (hrs/year)*

Detailed emission calculations for the marine equipment can be found in Tables A-1 to A-4, B-1 to B-3, and C-1 to C-4 in the reference document (Appendix F).

- The EPA, NONROAD emission factor model, Final 2005 Version, was used to predict emissions resulting from landside, off-road construction equipment used for beach placement with inputs for assumed equipment usage developed by the project sponsors. This model may be used to predict air emissions for off-road construction equipment based on information including geographic location, equipment type, and fuel use for specific years that may be selected. It provides an estimate of emissions for different equipment based on equipment population, load factor, available horsepower, deterioration and applicable standards.

  The NONROAD model was run to generate an emission factor for the criteria air contaminants, resulting from the use of bulldozers in Brazoria County during the model year of 2007. These emission factors were then used to estimate the total emissions from the use of bulldozers in dredged material reuse/placement activities associated with the project. Detailed emission calculations for the off-road construction equipment can be found in Tables D-1 to D-3 in the reference document (see Appendix F).

- Mobile on-road emissions associated with employee vehicles were calculated with the use of the EPA MOBILE6.2 emission factor model. MOBILE6 is a model for predicting emission factors from motor vehicles under various conditions. This model is recommended by the EPA for modeling of motor vehicle emission factors. The model accounts for general factors that may affect emission factors including changes in vehicle emission standards, changes in vehicle populations and activity, and variation in local conditions such as temperature, humidity, and fuel quality.

  A mix of light duty gasoline vehicles and light duty gasoline trucks was assumed for the makeup of the employee vehicles. An average commute of 25 miles each way was assumed for each vehicle. The total number of miles traveled equaled the number of miles per trip multiplied by the total number of days of activity times the number of vehicles. Detailed emission calculations for employee vehicles can be found in Tables E-1 and E-2 in the reference document (see Appendix F).

4.1.2.2 Air Quality Analysis Results

Emissions from the activities associated with Alternative 2 would include VOC, NO_X, CO, SO_X, PM_{10}, and $PM_{2.5}$. As $PM_{2.5}$ is a subset of PM_{10} particles, when the estimation model used did not specifically provide a $PM_{2.5}$ emission rate, the estimated $PM_{2.5}$ emission rate was conservatively assumed to be equivalent to that of PM_{10}. These activities would be considered one-time activities; i.e., the channel widening activities would not continue past the date of completion. Because of the high moisture content of the dredged material, it is expected that there will be no particulate matter emissions from the placement of dredged material on beaches.

A summary of the estimated emissions in tpy resulting from the use of harbor vessel equipment, nonroad equipment, and on-road equipment is presented in Table 4.1-1. Detailed summary of emissions can be found in Tables 1 to 10 in the reference document (see Appendix F).

TABLE 4.1-1

TOTAL ESTIMATED EMISSIONS BY SOURCE

Air Contaminant	Annual Harbor Vessel Emissions (tpy)	Annual Nonroad Vehicle Emissions (tpy)	Annual On-road Vehicle Emissions (tpy)
CO	49.07	0.14	0.661
NO_X	429.45	0.51	0.049
$PM_{2.5}$	9.73	0.02	0.0011
PM_{10}	10.27	0.02	0.0024
SO_2	71.26	0.02	0.0007
VOC	4.94	0.04	0.063

For a discussion of air quality impacts, the air contaminant emissions from Alternative 2 were compared to the 2001 emissions inventory for Brazoria County as described in Section 3.1.1. The comparison is presented in Table 4.1-2.

TABLE 4.1-2

TOTAL ESTIMATED PROJECT EMISSIONS
COMPARED WITH BRAZORIA COUNTY EMISSIONS (2001)

Air Contaminant	Maximum Estimated Project Emissions (tpy)	Brazoria County Emissions (tpy)	Site Emissions % of Brazoria County Emissions
CO	49.87	82,693	0.06
NO_X	430.01	53,790	0.80
$PM_{2.5}$	9.76	8,583	0.11
PM_{10}	10.29	39,743	0.03
SO_X	71.28	12,660	0.56
VOC	5.05	15,759	0.03

As shown in Table 4.1-2, air contaminant emissions from Alternative 2 would result in a relatively small increase in emissions above those from existing sources in the county. As a result, it is expected that air contaminant emissions from the combustion of fuel in equipment used for dredging and placement activities would also result in correspondingly minor short-term impacts on air quality in the immediate vicinity of the project area. Due to the anticipated short-term duration of the channel widening activities, there would be no long-term impacts and therefore, emissions from these activities are not expected to adversely impact the long-term air quality in the area.

4.1.2.3 General Conformity

With respect to General Conformity, all Federal Actions are covered unless otherwise exempt. A general conformity determination is required for each pollutant where the total of direct and indirect emissions in a nonattainment area would exceed emission thresholds as specified in the General Conformity Rules (40 CFR § 51.853(b) (1)). For the HGA, designated by the EPA as a nonattainment area, the exemption thresholds for O_3 precursor pollutants are 100 tpy of VOC or of NO_X. If the alternatives result in air emissions of less than 100 tpy for either of these air contaminants, the General Conformity rules do not require a General Conformity evaluation and no further analysis is required to demonstrate that such actions conform to the SIP. These actions may be presumed to conform and may be considered less than significant in terms of their impact on attainment of the 8-hour O_3 ambient air quality standard for this region.

For comparison with the thresholds defined in the General Conformity Rule, the estimated emissions of NO_X and VOC for the proposed alternative are summarized in Tables 4.1-3 and 4.1-4 for each year during which the project activities are anticipated to occur. Emissions of CO, SO_2, and particulate matter are not considered in the General Conformity evaluation, as this area is in attainment with the NAAQS for each of those pollutants.

As shown in Table 4.1-3, direct and indirect emissions of VOC for the activities subject to USACE responsibility are exempt from a General Conformity Determination because they are below the 100 tpy threshold.

TABLE 4.1-3

SUMMARY OF VOC EMISSIONS (tpy)

Activity	2007	2008
Dredging Activities – Dredging Vessel Equipment and Dredging Support Vessels	1.10	2.50
Dredging Vessels in Transit During Mobilization or Placement of Dredged Material	0.71	0.64
Land-side Dredged Material Placement – Bulldozing Equipment	0.04	--
On-Road – Employee Commuter Vehicles	0.03	0.03
Totals	**1.88**	**3.17**

As shown in Table 4.1-4, NO_X emissions for activities subject to USACE responsibility show the project would exceed the conformity threshold; i.e., greater than 100 tpy, for the years 2007 and 2008. Therefore, a General Conformity Determination for NO_X emissions would be required for these years. As part of the General Conformity process, the USACE, in consultation with the TCEQ and the EPA, will prepare a discussion on whether the emissions that would result from the proposed Freeport Channel Widening Project are in conformity with the Texas SIP for the Houston-Galveston Nonattainment Area. This document entitled "Draft General Conformity Determination, Freeport Channel Widening Project, Port of Freeport, Texas," October 2006 (PBS&J, 2006) will be prepared by the USACE for submittal to the TCEQ, EPA and other air pollution control agencies, as appropriate. As part of the general conformity process, the USACE will make this document available to the public for review and comments for a period of 30-days. Following the 30-day comment period, the USACE will prepare a Final General Conformity Determination that provides the USACE final determination with regard to the conformity of this project with the SIP.

TABLE 4.1-4

SUMMARY OF NO_X EMISSIONS (tpy)

Activity	2007	2008
Dredging Activities – Dredging Vessel Equipment and Dredging Support Vessels	84.98	196.21
Dredging Vessel Propulsion in Transit During Mobilization or Placement of Dredged Material	75.61	72.65
Land-side Dredged Material Placement – Bulldozing Equipment	0.51	–
On-Road – Employee Commuter Vehicles	0.02	0.02
Totals	**161.13**	**268.88**

4.1.3 Alternative 3: Proposed Action with Placement at Surfside

The alternative placement at Surfside will affect only the travel time made by marine vessels and dredge equipment. Since the distance traveled by marine vessels and dredge equipment to place dredged material at Surfside will differ only slightly, the estimated project emissions for this alternative would be essentially the same as discussed in Section 4.1.2, Alternative 2: Proposed Action with Placement at Quintana.

4.2 NOISE

Project-related noise impacts were evaluated by calculating the noise emissions related to dredge and placement operations of the proposed channel widening project at noise-sensitive receivers. Impacts were assessed by comparing the predicted noise emitted by typical dredge and construction equipment with the existing ambient noise levels in the vicinity of the project area. Noise levels at noise-sensitive receivers were estimated based on numerous properties of noise attenuation and industry accepted standards. The following information summarizes assumptions and properties used in the calculation of estimated noise levels.

Sound pressure levels of two separate sources are not directly additive. Therefore, as shown in Table 4.2-1, if a sound of 60 dB is added to another sound of 60 dB, the resulting noise level is 63 dB, not 120 dB. For example, if the noise level of a hopper dredge is measured at 85 dB at 50 ft, and the noise level of a tug boat is measured at 82 dB at 50 ft, the combined noise level of both would be approximately 87 dB. Also, noise attenuation between dredge activities and sensitive receivers was calculated based on the assumption that noise attenuates 6 dB per doubling distance from its source. For example, if dredging activities are measured at 87 dB at 50 ft, the noise levels would decrease by 6 dB at 100 ft (81 dB), decrease an additional 6 dB at 200 ft (75 dB), and decrease to 69 dB at 400 ft, etc.

TABLE 4.2-1

DECIBEL ADDITION

Difference Between Two Sources	For Example	Add To Higher Level	Resultant Sound Level
0 dB	60 and 60 dB	3 dB	63 dB
1 dB	60 and 61 dB		64 dB
2 dB	60 and 62 dB	2 dB	64 dB
3 dB	60 and 63 dB		65 dB
4-9 dB	60 and 65 dB	1 dB	66 dB
10 or more	60 and 70 dB	0 dB	70 dB

Source: TxDOT, 1996.

4.2.1 Alternative 1: No-Action

Under the No-Action alternative, the channel would not be widened to project specifications. However, the existing regime of maintenance dredging, which generally includes a hopper dredge and tending boats, would continue as normal. The majority of mechanical dredging equipment on a hopper dredge is housed below the vessel's deck; therefore, noise levels associated with the equipment are comparable to tug boats. Table 4.2-2 summarizes dredging-related noise levels produced by equipment type.

TABLE 4.2-2

TYPICAL NOISE LEVELS

Equipment	Noise Level (dBA)
Cutterhead Dredge (at 160 ft)	79[1]
Hopper Dredge (at 50 ft)	87[2]
Large Tug boat (at 50 ft)	87[3]
Small Tug Boat	72[3]
Bulldozer (at 50 ft)	82[4]
Bucket Crane (at 50 ft)	82[4]

[1] Geier & Geier Consulting, 1997.
[2] Assumed same as large tug.
[3] Epsilon Associates, 2006.
[4] FHWA, 2006.

No permanent noise impacts will result under the no-action alternative The nearest noise-sensitive receivers are located within Surfside Beach. The Surfside Beach Jetty Park is located approximately 220 ft from the channel, and the nearest residences are located approximately 880 ft from the channel. Noise levels during the maintenance dredging operations were estimated to be 75 dBA and 63 dBA at the park's shoreline and nearest residences, respectively. As discussed in Section 3.2, existing ambient noise levels ranged from 49 dBA to 61 dBA (hourly L_{eq}). The No-Action alternative does not result in permanent noise impacts, however, short-term noise-level increases of approximately 14 dBA to 26 dBA at the Surfside Beach Jetty Park, and approximately 2 dBA to 14 dBA at the nearest residences are expected during periodic dredging maintenance activities.

4.2.2 Alternative 2: Proposed Action with Placement at Quintana

Under Alternative 2, the channel would be widened to project specifications with placement of 300,000 cy of silty sand dredged material on the Quintana shoreline and the rest of the dredged material offshore. Equipment and duration for the proposed action includes a cutterhead dredge, one small tug boat, one large tug boat, two runabouts in the jetty channel for approximately 24 hours/day for 12 days; a bucket crane, one large tug, and one runabout in the jetty channel for approximately 19 days; and a hopper dredge, two runabouts, and a shrimp boat in the channel for an estimated 265 days.

The proposed action under Alternative 2 is not expected to result in long-term noise impacts. No permanent noise sources will be installed as part of this project. The proposed action, however, will create short-term noise impacts at noise-sensitive receivers during construction and maintenance dredging. Dredging operations during construction are expected to have the greatest impact during the 12-day period that the cutterhead dredge and its associated support vessels are operating. It was estimated that noise-levels on the shoreline at Surfside Beach Jetty Park could reach 79 dBA, while noise-levels at the nearest residences could reach approximately 67 dBA. This reflects a temporary increase of 17 dB to 30 dB over ambient conditions at the park, and a temporary increase of 6 dB to 18 dB over ambient conditions at the nearest residences. Therefore, when compared to current maintenance dredging operations, noise levels associated with the proposed action are expected to increase by approximately 3 to 6 db at Surfside Beach Jetty Park by approximately 4 db at the nearest residences. Hopper dredging and operation of the bucket crane are expected to be slightly louder than cutterhead dredging. Short-term impacts related to these operations would be nearly identical to the short-term impacts that occur during current maintenance dredging as discussed above in Section 4.2.1.

4.2.3 Alternative 3: Proposed Action with Placement at Surfside

Under Alternative 3, the channel would be widened to project specifications with placement of silty sand dredged material on the Surfside shoreline. Equipment and duration for the proposed action is identical to those of Alternative 2.

The proposed action under Alternative 3 is not expected to result in long-term noise impacts. No permanent noise sources will be installed as part of this project. The proposed action, however, will create short-term noise impacts at noise-sensitive receivers that are identical to those under Alternative 2.

4.3 PHYSIOGRAPHY, TOPOGRAPHY, AND BATHYMETRY

4.3.1 Alternative 1: No-Action

The No-Action alternative would have no impact on physiography, topography, or bathymetry. However, alterations to bathymetry from maintenance dredging of existing ship channels and changes from the placement of that dredged material at DMPAs, would continue under the No-Action scenario. In the absence of project activity, the existing patterns of shoreline erosion on both the Surfside and Quintana beaches are expected to continue. The current average rate of shoreline retreat is approximately 9 to 10 ft per year (GLO, 2006).

4.3.2 Alternative 2: Proposed Action with Placement at Quintana

Widening of the Freeport Entrance and Jetty Channels will change the bathymetry within the existing channels. The proposed channel widening would impact approximately 5.25 miles of the existing Freeport Harbor Channel from the Lower Turning Basin to (offshore) Channel Station -220+00.

The channel widening to 600 ft would generate approximately 3.2 mcy of dredged material. Of this, approximately 300,000 cy of material is silty sand and can be used for beach nourishment. At a fill template of 50 cy per linear foot, this would create approximately 9 acres of beach area at initial equilibrium. About 1.25 miles of shoreline (~91 acres) located along Quintana Beach would be affected by the proposed beach nourishment. It is expected that the material will increase the elevation of the beach by 1 to 2 ft and move the shoreline contours out roughly 50 to 100 ft. During the time placement is occurring, a high degree of turbidity is expected because the material is less than 90% sand. Once the material is exposed to wave action, the finer particles will be carried away and the remaining sand should be suitable for beach use.

Erosion tends to occur in relatively brief storm events which may or may not occur in any given year, thus it is not feasible to predict how long the material will remain on the beach. It clearly will not reverse the long-term rate of shoreline recession of 9 to 10 ft per year. While Alternative 2 will not reverse the trend, it will extend the period of time until erosion impacts the seaward levee of the Seaway PA.

While local changes would occur to bathymetry and topography with construction of the proposed project, these alterations would be expected to have negligible impacts on the regional physiography, topography, and bathymetry of the submerged and subaerial portions of the project area.

4.3.3 Alternative 3: Proposed Action with Placement at Surfside

The effects of this alternative are similar to that of Alternative 2, but the 300,000 cy of material would be placed on the Surfside Beach. One difference is that while the Quintana Beach is largely undeveloped, the Surfside beach has extensive private residences, some of which are now on land that appears to be below Mean High Water. This can be expected to pose more technical challenges in the material placement.

Similar to Alternative 2, the long-term effect of placement of the material on the Surfside beach will be positive in terms of delaying the shoreline retreat, but it will not provide a permanent solution to the problem.

While local changes would occur to bathymetry and topography during construction of the proposed project, these alterations would be expected to have negligible impacts on the regional physiography, topography, and bathymetry of the submerged and subaerial portions of the project area.

4.4 GEOLOGY

4.4.1 Alternative 1: No-Action

The No-Action alternative would not impact geology within the project area.

4.4.2 Alternative 2: Proposed Action with Placement at Quintana

Under alternative 2, the impacts on the local geology during dredging associated with the proposed project would include redistribution of existing sediment and potential changes of local scouring and shoaling rates. Net impacts on local geology are anticipated to be minimal from these operations.

Additionally, no impacts or modifications to geologic hazards such as faulting, subsidence, and jetty stability are expected. The most recent study for jetty stability showed that jetty stability would not be jeopardized by the proposed widening (Fugro, 2005).

4.4.3 Alternative 3: Proposed Action with Placement at Surfside

The effects of this alternative are similar to that of Alternative 2.

4.5 ENERGY AND MINERAL RESOURCES

4.5.1 Alternative 1: No-Action

The No-Action alternative would have no impact on energy or mineral resources. None of the project area or proposed PAs are actively involved in the commercial mining of minerals or the production of energy. Maintenance dredging of existing ship channels would continue under the No-Action scenario.

4.5.2 Alternative 2: Proposed Action with Placement at Quintana

There are no reported oil/gas wells located within the project area that will be directly or indirectly impacted by the proposed dredging or dredged material placement components of the project. There are two reported pipelines that cross the ship channel within the Entrance Channel. The depth of these pipelines is undetermined, but since the current channel depth would be maintained, no direct impact is anticipated. None of the reported petroleum pipelines are located within the proposed DMPAs or along the portions of the coastline identified for beach nourishment (Railroad Commission of Texas, 2006).

4.5.3 Alternative 3: Proposed Action with Placement at Surfside

The impacts of this alternative are identical to those described for Alternative 2.

4.6 SOILS

4.6.1 Alternative 1: No-Action

Any impact of the No-Action alternative on surface soils would depend on the type of future development that would take place within the proposed beach nourishment areas of the project site.

4.6.2 Alternative 2: Proposed Action with Placement at Quintana

Under this alternative, the proposed beach nourishment area located along Quintana beach would be impacted by placement of 300,000 cy of silty sand material. However, due to ongoing shoreline erosion and periodic beach maintenance such as grooming and sand importation, impacts to native surface soils within this project area would be consistent with current practices. Furthermore, precautions are exercised to preserve any existing dunes during dredge pipeline placement and discharge operations and adverse impacts are not expected during these operations.

Possible impacts to surface soils exist from the potential release of petroleum products during construction and hazardous material spills from hazardous cargo during shipping operations. However, the use of BMPs for potential hazardous material spills that could occur at the project area would greatly minimize the potential for this type of impact, and shipping operations should be safer than at present.

4.6.3 Alternative 3: Proposed Action with Placement at Surfside

The effects of this alternative are similar to that of Alternative 2.

4.7 GROUNDWATER HYDROLOGY

4.7.1 Alternative 1: No-Action

The No-Action alternative would not impact groundwater hydrology within the project area. Any groundwater quality impacts are contingent upon the amount and type of development that would take place in lieu of beach nourishment on the project site.

4.7.2 Alternative 2: Proposed Action with Placement at Quintana

Construction and operation activities associated with the proposed project are not expected to result in impacts to groundwater hydrology, quantity, or quality. In addition, no groundwater withdrawals are anticipated for the project. No apparent private, public or industrial water wells registered with the TWDB (2006) would be destroyed and/or affected from the proposed project based on their proximal distances and completed depths below surface grade.

Other possible impacts to shallow groundwater exist from the potential release of petroleum products during construction and hazardous material spills from shipping interests; however, the use of BMPs for potential hazardous material spills that could occur at the project area would greatly minimize the potential for this type of impact, and shipping operations should be safer than at present. BMPs which meet local, State and Federal requirements would be developed and implemented as part of the Spill Response Plan for the project to address potential spills.

4.7.3 Alternative 3: Proposed Action with Placement at Surfside

The effects of this alternative are the same as Alternative 2.

4.8 HAZARDOUS MATERIALS

4.8.1 Alternative 1: No-Action

The No-Action alternative would have no impact on regulated facilities or sites associated with a release, storage, disposal, or generation of hazardous material or hazardous waste. However, maintenance dredging of existing ship channels would continue under the No-Action scenario.

4.8.2 Alternative 2: Proposed Action with Placement at Quintana

The history of industrial activity along the Freeport Ship Channel has resulted in quantifiable impacts to the air, soil, groundwater, and surface water. The Freeport Harbor Channel receives surface water runoff, wastewater discharge, and some groundwater discharge from these industrial facilities. Some of these contaminants can accumulate in the sediment of the waterway. Therefore, the potential exists for the project to encounter contaminated material during dredging activities. However, these industrial facilities are landward of the project footprint, and according to the results of chemical analysis on ten samples of

sediment and soil collected from the entrance channel (PBS&J, 2005), no detectable concentrations of organic halides, VOCs, pesticides, or PCBs were reported. Only one semivolatile organic compound (fluoranthene) was detected in one sample. Several metals were also reported, but only one (nickel) exceeded a conservative screening level for marine sediment. Based on this information, there is only a slight potential for encountering contaminated material during construction of the project.

4.8.3 Alternative 3: Proposed Action with Placement at Surfside

The impacts of this alternative are the same as those described for Alternative 2.

4.9 WATER AND SEDIMENT QUALITY

4.9.1 Water Quality

4.9.1.1 Water and Elutriate Chemistry

4.9.1.1.1 Alternative 1: No-Action

Under the No-Action alternative, there would be no construction dredging; therefore, there would be no new work material for placement. Although no turbidity or possibility for the release of undesired chemicals would occur because there would be no placement, likewise, there would be no chance for the increase of safety and the concomitant decrease in the possibility of spills of contaminants and no beach nourishment would occur.

Under the No-Action alternative, the effects of maintenance material disposal on water quality would be as it is presently, as described in Section 3.9.2.

The No-Action alternative may or may not affect DO concentrations in the water column at ODMDSs (Brown and Clark, 1968; Pearce, 1972; Hopkins, 1972; May, 1973; Windom, 1972; Wakeman, 1974). May (1973) found that although the water column DO did not change, there was a temporary decrease in DO at the water/sediment interface in the areas of mud flow. He also found little apparent difference in the immediate oxygen demand between recently deposited sediments from dredged material placement and other sediments. May (1973), Jones and Lee (1978), Peddicord (1979), and Lee (1976) agree that high total oxygen demand, as measured in the laboratory, does not necessarily lead to oxygen depletion upon placement since only a small part of the oxygen demand is exerted at placement and the only placement at Freeport during maintenance activities would be offshore in 35 to 40 ft of water.

The most obvious impact of the No-Action alternative to the estuarine water column is turbidity associated with maintenance dredging and placement, which has been shown to reduce primary production in laboratory studies (Sherk, 1971). Field studies, however, have shown essentially no biological impacts from turbidity (Odum and Wilson, 1962; May, 1973), probably because both coastal and estuarine animals are accustomed to large variance in turbidity from a variety of sources; e.g., storms, tidal fluctuations, currents (Clarke and Wilber, 2000). May (1973) found that on a still day, the turbidity

plume from open-bay placement was detectable from an aircraft only a little more than a mile down current. On days when winds caused natural turbidity in an estuarine system, the plume was not detectable more than a few hundred yards down current from active disposal in an open-bay PA. Deeper water for the offshore placement, relative to the depths studied by May (1973), should reduce turbidity and any associated impacts. After conducting a literature review of the biological effects from suspended material produced by dredging operations, Clarke and Wilber (2000) state, "If a probable dredging-induced dosage of ≤1,500 mg/L for ≤1 day is assumed for motile fishes…documented detrimental impacts observed for juvenile and adults were limited to tests that used fuller's earth rather than natural sediments. Fuller's earth produces negative responses at lower concentrations than natural sediments (Sherk et al. 1974)." They also note that sessile animals are unlikely to be exposed for more than 5 days at a given hydraulic dredging site, even without tidal flushing. While this would not be true of sessile organisms in the active placement zone of an ODMDS, because of the site selection process, it would apply to any place outside the ODMDS, even at the edges. The suspended sediment concentrations that cause reduced growth in hard clams (Pratt and Campbell, 1956) and reduced survival in oysters (Kirby, 1994), are higher than can be expected in estuaries under natural conditions and during typical dredging operations (Clarke and Wilber, 2000). Colby and Hoss (2004) noted that Minello et al. (1987) had found reduced feeding in adult Atlantic croaker and pinfish but that the potential impact of TSS from dredging operations to larval fish was not well understood. Therefore, they conducted a study exposing five larval fish (menhaden, pinfish, spot, croaker, and flounder), collected with a 945-µm net, to varying concentrations of TSS (20, 200, 2,000, and 20,000 mg/L) and brine shrimp nauplii (1.0, 0.1, and 0.01 nauplii/ml) for 31 minutes. The prey consumption was determined in each of the 2.733 liter test vessels containing one of the combinations of TSS and prey concentrations, and logistic regression models were applied to the data. An additional experiment was conducted in which natural plankton assemblages were fed to menhaden, spot, and flounder to determine if there was a difference between consumption of natural prey and brine shrimp. They note that the highest two TSS concentrations are not likely to be encountered except very near dredges or discharges. The prey consumption varied among the species with spot and menhaden more likely to feed on natural prey than brine shrimp but flounder consumed more brine shrimp. Likewise, menhaden and flounder prey consumption correlated more strongly to TSS than prey concentration but flounder was most sensitive to both. Flounder did not feed when prey concentrations were low and TSS was high but did when the conditions were reversed. Pinfish, spot, and croaker consumption correlated more strongly to prey concentration and these larval fish fed even at the highest TSS concentrations. All of the animals fed, to some extent, at the three lower TSS concentrations.

Significant detrimental environmental effects have not been noted in past maintenance operations.

4.9.1.1.2 Alternative 2

The construction material has been tested for contaminants (Section 3.9.3.1) and no causes for concern were found. Therefore, there should be no water quality impacts from beach nourishment, aside from

turbidity as the silts and clays are winnowed away from the sands. Additional effects of ocean placement can be found in Appendix C.

There should be very little change in water quality impacts between Alternative 1 and Alternative 2. While there will be more maintenance material associated with Alternative 2, the source of the maintenance material will not change and the method of placement will not change. There is the possibility of contamination of the maintenance material by a spill or other event, as there is now, but widening the channel should increase safety and decrease the probability of a spill. Additionally, the USACE routinely tests the elutriates prepared from maintenance material according to RIA and Green Book protocols before dredging to ensure that there are no causes for concern. As noted in Section 3.9.2, Tier I and Tier II evaluations of maintenance material elutriates with chemical analyses and water column bioassays have indicated no cause for concern.

4.9.1.1.3 Alternative 3

Water quality impacts from Alternative 3 would be the same as those from Alternative 2 except for the location of the turbidity associated with beach nourishment.

4.9.1.2 Ballast Water

4.9.1.2.1 No-Action Alternative

Currently 882 ships enter the Freeport Harbor and release ballast water. Ballast water is one of the major pathways for the introduction of nonindigenous marine species (exotic species), having the potential to cause ecological and economic damage. Aquatic nuisance species (ANS) are those organisms whose introductions have adversely impacted their new habitats, becoming one of the greatest threats to the marine environment. Ballast water is pumped into the ballast tanks at one port and released into the ocean at the next port-of-call. This release of ballast water can introduce ANS into the port of discharge. ANS can thrive in their new environment due to the absence of their natural predators and in some cases displace native organisms by preying on them or out competing native species for food and habitat space. However, not all nonindigenous species introductions are harmful, and some may become economically profitable if they are harvested for food or commercial goods (USCG, 2006b).

In addition to the environmental impacts, economic damage may also occur when an ANS displaces species that are harvested for food or other goods, or when they damage structures. The public health impact also has the potential to be significant. The ballast water may contain biological contamination and when discharged into the local waters may infect fish and shellfish populations, which could be harvested for human consumption (USCG, 2006b).

4.9.1.2.2 Alternative 2

Under Alternative 2, impacts to ballast water will remain as described above since the number of vessels and the origins of those vessels is not predicted to change.

4.9.1.2.3 Alternative 3

Under Alternative 3, impacts to ballast water will remain as described above since the number of vessels and the origins of those vessels is not predicted to change.

4.9.2 Sediment Quality

4.9.2.1 Surficial Sediments (Construction Material)

4.9.2.1.1 Alternative 1: No-Action

There will be no construction material with the No-Action alternative.

4.9.2.1.2 Alternative 2: Proposed Action with Placement at Quintana

The quality of surficial sediments from the project area is discussed in Section 3.9.3.1. These are the surficial sediments that will be dredged during project construction. The discussion in Section 3.9.3.1 indicates no cause for concern with the construction material. The 300,000 cy of silty sand construction material was determined to be of sufficient quality to be used for BUs (PBS&J, 2005) on the Quintana Beach and there was no cause for concern for the fine material from the rest of the project, which is projected to be placed offshore.

4.9.2.1.3 Alternative 3: Proposed Action with Placement at Surfside

As with Alternative 2, there are no causes for concern with placing the 300,000 cy of silty sand material on the Surfside Beach. However, the material destined for beach nourishment is expected to contain only less than 90% sand and it will make the beach water muddy for some period of time. The only difference between Alternatives 2 and 3 is that the Quintana Beach is not in the immediate vicinity of a residential area, as is the Surfside Beach. Thus, aesthetic impacts associated with the placement of the silty sand material would be more noticeable at Surfside (see Section 4.17).

4.9.2.2 Maintenance Material

4.9.2.2.1 Alternative 1: No-Action

The existing maintenance material was described in Section 3.9.3.2. The quantity and quality of this material would not be expected to change with the No-Action alternative.

4.9.2.2.2 Alternative 2: Proposed Action with Placement at Quintana

The quantity and quality of this material would not be expected to change significantly with Alternative 2. While slightly more maintenance material is estimated with Alternative 2, the source of the maintenance material will not change and the method of placement will not change. As noted above, project actions should increase safety and decrease the probability of a spill. The USACE also routinely tests the maintenance material according to RIA and Green Book protocols before dredging to ensure that there are

no causes for concern. As noted in Section 3.9.3.2, past testing of maintenance material with chemical analyses, whole mud bioassays, and bioaccumulation studies has indicated no cause for concern.

4.9.2.2.3 Alternative 3: Proposed Action with Placement at Surfside

Alternative 3 is equivalent to Alternative 2 relative to maintenance material.

4.10 COMMERCIAL AND RECREATIONAL NAVIGATION

The main effect of the alternatives considered will be on allowing greater flexibility in handling large vessels, including LNG carriers, and in reducing the periods when there are restrictions on navigation, including concommitment cost savings. These restrictions, which include length and beam limitations during periods of cross winds and strong currents at the end of the jetties, are discussed in detail in Section 3.10.1.

4.10.1 Alternative 1: No-Action

Without the channel widening the existing restrictions on operations, described in section 3.10.1, would continue. These restrictions are accommodated in routine operations and would continue to be the case under the no-action alternative. However, there is a long-term trend of increase in vessel size such that the frequency of restriction can be expected to increase with time. In addition, the restrictions would be a negative factor in new proposed LNG carrier operations, as these vessels tend to be new and to have dimensions that would tend to encounter restrictions more often.

However, the no-action alternative would eliminate the temporary traffic delays that would be produced by either alternative 2 or 3 during construction.

4.10.2 Alternative 2: Proposed Action with Placement at Quintana

The proposed action would reduce the frequency of restrictions on operations and improve the efficiency of the Port. The effect would be most significant for the larger vessels, and would not affect smaller vessels. TranSystems Corporation (2006) estimated that two-way traffic with the 600-ft-wide channel would reduce vessel delay times by 1,185 hours annually in 2010 and by 5,540 hours annually in 2060. This translates into present value economic benefits to the Port and Nation of at least $24.37MM over the 50-year life of the project or total annual National Economic Benefits of $487,415 (Martin Associates, 2006).

Relative to safety, it is assumed that routine operations at the Port would be conducted to maintain an equivalent level of safe navigation for all vessels. The greater channel width would have the effect of reducing delays for larger vessels, but would not be presumed to produce a net increase in the level of safety for these vessels. Vessels not subject to operational restrictions would experience a larger channel and a greater safety margin for normal operations.

All vessel traffic would experience some delays during the dredging process. This can be minimized through scheduling and planning, but would be a factor due to the constrained nature of the channel. However, since most dredging would likely be accomplished by a mobile hopper dredge and be restricted to the widened portion of the channel, delays during dredging should be small.

4.10.3 Alternative 3: Proposed Action with Placement at Surfside

There is not expected to be a significant difference between alternatives 2 and 3 in terms of commercial and recreational navigation.

4.11 VEGETATION

4.11.1 Alternative 1: No-Action

Most of the uplands in the project area are developed (urban or industrial). It is assumed that the undeveloped upland areas will be developed as the Port of Freeport and the communities of Freeport, Surfside, and Quintana continue to grow.

4.11.2 Alternative 2: Proposed Action With Placement at Quintana

Because the proposed channel widening project is limited to the open water areas of the Entrance and Jetty Channels of the Freeport Harbor Channel, there should be no additional impacts to uplands from dredging associated with construction of the proposed project beyond what is expected for the No-Action alternative.

Although marsh creation and/or restoration options were evaluated during the development of the DMMP, no suitable sites were identified (see Appendix B). The only potential impacts associated with the DMMP would be from the BU of dredged material on the Gulf shoreline in front of the Seaway PA for beach nourishment. It is assumed that placement would occur on unvegetated parts of the beach, so no plant communities would be directly impacted. There may be positive impacts by mitigating the erosion of the beach and dune complex and also, by enhancing accretion of the active delta of the Brazos River. The active delta would be affected because the dredged material would be ultimately transported southwest along the shoreline by longshore drift and accumulate on the delta. More of the dredged material would be transported to the delta with this alternative than with the No-Action alternative.

4.11.3 Alternative 3: Proposed Action With Placement at Surfside

The potential impacts associated with this alternative are similar to those described for Alternative 2, except that the beach nourishment on Surfside Beach would not be expected to contribute much, if any, material to the accretion of the active delta of the Brazos River. As described in Section 3.3, the longshore drift to the southwest would be blocked by the jetties.

4.12 WETLANDS

4.12.1 Alternative 1: No-Action

The condition and distribution of wetland types can be affected by changes in depth and frequency of inundation as well as salinity. There are three primary factors affecting the potential impact of the proposed project on wetlands.

- No wetlands are located in the footprint of the proposed project. The largest wetlands near the project are primarily north and south of the area near the Harbor Channel.
- The proposed project is limited to widening an existing channel, which would minimize potential changes to salinity and tidal inundation.
- The Brazos River diversion in 1929 cut off the direct connection between the river and the freshwater inflow into the Freeport Harbor Channel, leading to concomitant changes in the wetland community in response to the changes in physical factors since that time.

Unlike the expected industrial and urban development of the upland areas, development of the wetlands will be more limited because of State and Federal protection.

Evaluating the impacts of changes that will occur without the proposed project is confounded by ongoing changes in relative sea level. White et al. (2005) found that relative sea level rise in the Freeport area exceeded 0.43 in/yr from 1959 through 1971. The overall relative sea level is also affected by subsidence, which may have been as much as 5 ft from 1943 to 1973 in the Freeport area (White et al., 2005). Assuming it will continue into the future, the impact of this change would be profound in comparison to the proposed project.

4.12.1.1 Estuarine Submerged Aquatic Vegetation

There is no aquatic vegetation mapped (FWS, 1992a) within 1 mile of the proposed project and none was observed in the immediate area of the ship channel during recent site visits. The No-Action alternative would not directly impact SAV since there will be no dredging of new work material. Dredged maintenance material from the existing channels would continue to be placed offshore and would have no impacts on SAV.

4.12.1.2 Estuarine Marshes, Tidal Flats, Scrub-Shrub Wetlands

These habitats occur closer to the proposed project than do SAV, although still not within the footprint. They are not directly adjacent to the channel and, therefore, are not susceptible to shoreline erosion.

Continued industrial expansion coupled with increased ship traffic increases the probability for collisions and hazardous materials spills under the No-Action alternative, which could negatively impact the wetlands.

4.12.1.3 Freshwater Wetlands (Aquatic Vegetation, Marshes, Scrub-Shrub, Flats, Forested Wetlands)

There are few freshwater wetlands within the project area. A review of historic aerial photographs shows that past development has already converted most to uplands. Continued industrial and urban expansion would be expected to impact the remaining freshwater wetlands.

4.12.2 Alternative 2: Proposed Action With Placement At Quintana

4.12.2.1 Estuarine Submerged Aquatic Vegetation

The proposed alternative would have similar lack of positive or negative impacts on SAV as the No-Action alternative. The only changes in this community would be associated with salinity changes, but none are expected. It may be assumed that, if any changes occur, they would be minor and well within the tolerances and natural ranges of the common SAV species. Also, considering the distance of any known SAV beds from the project, any impact seems highly unlikely. Estuarine SAV in the inter-ridge swales of the Brazos River delta may receive some protection from Gulf shoreline erosion as a result of proposed beach nourishment associated with Alternative 2.

4.12.2.2 Estuarine Marshes, Tidal Flats, Scrub-Shrub Wetlands

It is unlikely that the minimal changes in salinity and tidal influence would have significant impact on the vegetative communities within any of these habitats. If there were measurable changes in the wetland communities, minor shifts in species composition would be more likely than major changes in geographic distribution, community type (e.g., salt to brackish marsh), or marsh loss (conversion to open water). Like SAV, the deltaic marshes could indirectly benefit from beach nourishment associated with the DMMP.

4.12.2.3 Freshwater Wetlands (Aquatic Vegetation, Marshes, Scrub-Shrub, Flats, Forested Wetlands)

The only freshwater wetlands that could be conceivably impacted by the proposed project would be those with some hydrologic connection to the estuarine waters. Since the ship channel is no longer part of the Brazos River, many of the connections are indirect (e.g., via the GIWW). The lack of direct connection and distance from the proposed project make it highly unlikely that any measurable impact would occur. This includes the inland area of the Columbia Bottomlands.

4.12.3 Alternative 3: Proposed Action With Placement At Surfside

4.12.3.1 Estuarine Submerged Aquatic Vegetation

This alternative would have the same impact on estuarine SAV as Alternative 2 other than the possible differences in contributions to Brazos River delta and SAV within its inter-ridge swales associated with the DMMP.

4.12.3.2 Estuarine Marshes, Tidal Flats, Scrub-Shrub Wetlands

This alternative would have the same impact on estuarine wetlands as Alternative 2 other than the possible differences in contributions to Brazos River delta and marshes within its inter-ridge swales.

4.12.3.3 Freshwater Wetlands (Aquatic Vegetation, Marshes, Scrub-Shrub, Flats, Forested Wetlands)

This alternative would have the same impact on wetlands as Alternative 2.

4.13 TERRESTRIAL WILDLIFE

4.13.1 Alternative 1: No-Action

Under the No-Action alternative, impacts to the terrestrial wildlife species or wildlife habitats at or near the proposed project area would continue to occur consistent with current channel maintenance activities.

4.13.2 Alternative 2: Proposed Action with Placement at Quintana

4.13.2.1 Dredging/Construction Activities

While dredging activities from the proposed project are unlikely to have a direct impact on terrestrial wildlife species, they may have an indirect impact. Such activities may cause temporary, local impacts to aquatic communities and habitats, including increased turbidity (Section 4.9.1), which in turn may indirectly affect birds in the immediate vicinity by potentially reducing the availability of the food supply. These impacts are local and temporary and are not likely to be significant, considering the overall availability of similar habitats in the general area and the mobility of the birds. The slightly increased possibility of accidental spills of oil, chemicals, or other hazardous materials during construction dredging activities also poses a threat to the aquatic community and, thus, the food source of many coastal birds in the area. Accidental spills could adversely affect phytoplankton and zooplankton assemblages, which make up the foundation of the aquatic food chain. While adult shrimp, crabs, and fish are mobile enough to avoid areas of high concentrations of pollutants, larval and juvenile finfish and shellfish are more susceptible to those threats. Any effects would be short-term.

The noise of equipment and increased human activity during construction dredging activities (Section 4.2) may disturb some local wildlife, particularly birds, especially during the breeding season. Such impacts, however, should be temporary and without significant long-term implications. Salinity effects are unlikely and most infaunal organisms in the area are relatively tolerant of salinity fluctuations.

Dredging activities for the channel improvement would occur immediately adjacent to Rookery 610-101 (FWS, 2006b) (Bryan Beach State Park), which is on the north shore of the Freeport Channel (see Figure 3.13-1). This rookery historically supported nesting populations of black skimmer (*Rynchops niger*) and least tern; however, the black skimmer has not nested at the site since 1991 and least terns have

been absent since 1982 (FWS, 2006b). Other rookeries in the study area include 610-100 (Freeport Dow), 610-102 (Bryan Beach Spoil), 610-103 (Bryan Mound), 610-104 (Dow Gate A-40), 610-105 (Dow Tern), and 610-106 (Bryan Beach Diked Spoil). Dredging activities associated with the proposed project would not result in impacts to these rookeries, however.

Approximately 300,000 cy of the dredged material would be deposited in front of the Seaway PA on Quintana Beach. Placement of dredged material at this site would have similar impacts to the dredging activities in that they would be unlikely to result in direct effects on terrestrial wildlife species but may have indirect effects. Temporary impacts to aquatic communities and habitat from increased sedimentation and turbidity would be expected. This in turn may affect birds in the area by potentially reducing the availability of their local food supply temporarily. The impacts may be more noticeable since the site is located near known bird rookeries. Noise and increased human activities during construction may temporarily affect terrestrial wildlife in areas adjacent to the BU sites. These impacts would likely be minor and short-term.

Construction activities during the placement of material on the beach may temporarily preclude its use by wildlife; however, the duration of the activity will be temporary and size of the construction area would not be large enough to cause any significant loss of habitat. The resultant additional beach will provide additional terrestrial habitat for wildlife in the area. Therefore, the proposed activity may affect, but is not likely to adversely affect terrestrial wildlife.

4.13.2.2 Operational Activities

Upon completion of the initial dredging activities associated with the project, few impacts are likely. Maintenance dredging activities would have similar temporary impacts as the initial dredging, but on a much smaller scale and for a shorter term and would be similar to existing maintenance activities. The number of vessels in the area would not increase or decrease; therefore, the potential for erosion of PAs would not change. The possibility of accidental oil or chemical spills would decrease because of safer navigability. Such spills pose a threat to the aquatic community and, thus, the food source of many coastal birds in the area. Impacts from noise and human activity are unlikely to be a factor and should increase only slightly over existing maintenance conditions.

4.13.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts to wildlife resulting from dredging/construction and operational activities associated with Alternative 3 would be similar to those associated with Alternative 2.

4.14 AQUATIC ECOLOGY

4.14.1 Alternative 1: No-Action

4.14.1.1 Aquatic Communities

Under Alternative 1, aquatic communities will remain as described in Section 3.14.1. Impacts from current maintenance dredging include increased water column turbidity during and for a short time after dredging activities and burial of benthic organisms. No long-term effects are to be expected.

4.14.1.1.1 Recreational and Commercial Species

Under the No-Action alternative, current maintenance dredging operations would continue and impacts to recreational and commercial species will remain as described in Section 3.14.1.1. Impacts from current maintenance dredging include altering or removing productive fishing grounds and short-term increases in turbidity, although reductions in the numbers of important species are not expected.

4.14.1.1.2 Oyster Reef Habitat

Under Alternative 1, oyster reef habitat will remain as described in Section 3.14.1.2.

4.14.1.1.3 Offshore Sands

Under Alternative 1, offshore sand habitat will remain as described in Section 3.14.1.3. Impacts from current maintenance dredging include increased water column turbidity and burial of benthic organisms, although no long-term effects are expected.

4.14.1.1.4 Artificial Reefs

Under Alternative 1, artificial reefs will remain as described in Section 3.14.1.4.

4.14.1.2 Essential Fish Habitat

Under Alternative 1, EFH will remain as described in Section 3.14.2. Impacts from current maintenance dredging include short-term increases in water column turbidity, although no long-term effects are expected.

4.14.2 Alternative 2: Proposed Action with Placement at Quintana

4.14.2.1 Aquatic Communities

Construction and future maintenance activities will generate suspended solids and turbidity, as have past construction and maintenance activities. Turbidity in estuarine and coastal waters is generally credited with having a complex set of impacts on a wide array of organisms (Thompson, 1973; Hirsch et al., 1978; Stern and Stickle, 1978; Wright, 1978). Suspended material can play both beneficial and detrimental roles

in aquatic environments. Turbidity from TSS tends to interfere with light penetration and thus reduce photosynthetic activity by phytoplankton. Such reductions in primary productivity would be localized around the immediate area of the maintenance dredge operations and construction dredging and placement, and would be limited to the duration of the plume at a given site. Conversely, the decrease in primary production, presumably from decreased available light, has been found to be offset by increased nutrient content (Morton, 1977). In past studies of impacts of dredged material placement from turbidity and nutrient release, the effects are both localized and temporary (May, 1973; Odum and Wilson, 1962; Brannon et al., 1978). Thus, due to the capacity and natural variation in phytoplankton populations, the impacts of maintenance dredged material placement and construction dredging within the project area are not expected to be significant.

Although water column turbidity would increase during the project construction and maintenance dredging, such effects are usually temporary and local. Detrimental effects are generally recognized at TSS concentrations greater than 500 mg/L and for durations of continuous exposure ranging from several hours to a few days. Turbidities exceeding 500 mg/L have been observed around maintenance dredging and placement operations (EH&A, 1980), and such turbidities may affect some aquatic organisms near the active dredges and outflow weirs. In a study in Corpus Christi Bay, Schubel et al. (1978) reported TSS values greater than 300 mg/L but only in a relatively small area near the bottom. They also found that TSS from maintenance dredging in Corpus Christi Bay is not greater than that from shrimping and affects the bay for much shorter time periods. May (1973) found that TSS was reduced by 92% within 100 ft of the discharge point, by 98% at 200 ft, and that concentrations above 100 mg/L were seldom found beyond 400 ft from the point of placement. Elevated turbidities during construction and maintenance dredging may affect some aquatic organisms near the dredging activity; however, turbidities can be expected to return to near ambient conditions within a few hours after dredging ceases or moves out of a given area. Shideler (1984) reports similar TSS levels from dredging and storm events. Overall, motile organisms are mobile enough to avoid highly turbid areas (Hirsch et al., 1978). Under most conditions, fish and other motile organisms are only exposed to localized suspended-sediment plumes for short durations (minutes to hours) (Clarke and Wilber, 2000).

Effects of elevated turbidities on the adult stages of various filter-feeding organisms such as oysters, copepods, and other species include depression of pumping and filtering rates and clogging of filtering mechanisms (Stern and Stickle, 1978). These effects are pronounced when TSS ranges from 100 to 1,000 mg/L and higher, but are apparently reversible once turbidities return to ambient levels. Notwithstanding the potential harm to some individual organisms, compared with the existing condition, no significant impacts to finfish or shellfish populations are anticipated from project construction or maintenance dredging activities.

Dredging represents two problems for benthic communities: excavation and disposal; however, disposal is more harmful than excavation. Excavation buries and removes organisms, but organisms can rapidly recolonize, whereas disposal smothers or buries existing benthic communities. Placement of dredged material may cause ecological damage to benthic organisms in three ways: (1) physical disturbance to

benthic ecosystems; (2) mobilization of sediment contaminants, making them more bio-available; and (3) increasing the amount of suspended sediment in the water column (Montagna et al., 1998). Organisms that are buried must vertically migrate or die (Maurer et al., 1986). Maurer et al. (1986) demonstrated that many benthic organisms were able to migrate vertically through 35 inches of dredged material under certain conditions; however, the species present in early successional stages of recovery are not the same as those buried by the dredged material. Although vertical migration is possible, most organisms at the center of the disturbance do not survive, and survivability was shown to increase as distance from the disturbance increased (Maurer et al., 1986).

Repeated dredging in one place may prevent benthic organisms from fully developing (Dankers and Zuidema, 1995). Evacuation destroys the community that previously existed but creates new habitat for colonization (Montagna et al., 1998). Evacuation can actually maintain high rates of macrobenthos productivity (Rhoades et al., 1978). By repeatedly creating new habitat via disturbance, new recruits continually settle and grow. However, these new recruits are always small, surface-dwelling organisms with high growth rates. Large, deep-dwelling organisms that grow slower and live longer are lost to the areas of repeated excavation. In this way, excavation may not cause a decrease in production, but rather a shift in community structure (Montagna et al., 1998).

Placement of construction and maintenance dredged material at the proposed offshore placement sites would bury those benthic organisms incapable of escaping or burrowing up through the dredged material. Burial of benthic organisms will occur during initial construction placement offshore, but the material is virgin ocean bottom, and so recolonization should be rapid (see Appendix C for more detail). Benthic community structure and abundance will eventually return to pre-placement levels at the ODMDS site since it will be used once only for placement of construction material. Potential beneficial effects of the suspended material associated with dredging operations include a resuspension of nutrients, absorption of contaminants in the water column, and addition of a protective cover allowing certain nekton to avoid predation (Stern and Stickle, 1978). As with various potential detrimental effects, the importance of each of these latter effects would vary among groups and with the physiochemical parameters existing at the time of dredging and placement operations.

With the widening of the channel, a slight increase in salinity may be observed. Most organisms occupying these environments are ubiquitous along the Texas and Louisiana coast and can tolerate a wide range of salinities (Pattillo et al., 1997; Parker, 1965). Additionally, no sensitive estuarine or marsh environments occur within the Freeport Harbor Channel and therefore no adverse effects are expected to occur to finfish or shellfish populations due to changes in salinity.

In the unlikely event a petroleum product spill should occur, adult crustaceans, such as shrimp and crabs, and adult finfish are probably motile enough to avoid most areas of high oil concentrations. Larval and juvenile finfish and shellfish tend to be more susceptible to oil than adults and could be affected extensively by an oil spill during their active immigration periods. Due to their lack of mobility, they are less likely to be able to avoid these areas and could be negatively impacted if a spill were to occur.

Benthic fauna may be killed, but phytoplankton may be adversely or favorably affected by oil spills. It is unlikely that an oil spill in the project area would result in significant, long-term impacts to either phytoplankton or benthic communities, since these organisms have the ability to recover rapidly from a spill due primarily to their rapid rate of reproduction and to the widespread distribution of dominant species. There should be a slight decrease in the likelihood of oil spills with Alternative 2, relative to the No-Action alternative.

4.14.2.1.1 Recreational and Commercial Species

Temporary and minor adverse effects to recreational and commercial fisheries may result from altering or removing productive fishing grounds and interfering with fishing activity. However, no significant impacts to food sources for nekton are likely, therefore, reductions of nekton standing crops would not be expected. Major species of nekton, including sciaenid fishes and penaeid shrimp, should not suffer any significant losses in standing crop. Thus, the limited amount of recreational and commercial fishing would not be expected to suffer from reductions in the numbers of important species.

Repeated dredging and placement operations for channel maintenance may temporarily reduce the quality of recreational and commercial fisheries in the vicinity of dredging operations. This may result from decreased water quality and increased turbidity during dredging as well as from a loss of attractiveness to game fish resulting from loss of benthic prey. This condition is not permanent and the quality of fishing in the vicinity of the channel and PAs should steadily improve after dredging is completed and would likely be similar to existing maintenance dredging, as described for Alternative 1. Maintenance dredging operations will only cause temporary effects to the immediate area during the proposed dredging process.

During construction dredging, game fish would leave prime recreational fishing areas for more favorable, less turbid locations; however, once construction is completed, conditions would improve and game fish will return to the area. The placement of 2.9 mcy of dredged material in an existing, but inactive, ODMDS offshore may result in a localized effect on recreational and commercial fishing in the area. However, construction activity should not significantly affect overall fishing in the general project area.

4.14.2.1.2 Oyster Reef Habitat

Under Alternative 2, oyster reef habitat will remain as described in Section 3.14.1.2.

4.14.2.1.3 Offshore Sands

Water column turbidity would increase during the project construction and maintenance dredging but such effects are temporary and local. Offshore placement of construction and maintenance dredged material is located in sites already designated for placement or currently being used for placement. At the ODMDS site, benthic organisms would be buried and subsequently killed during placement of the construction dredged material; however, recolonization should be rapid. Benthic community structure and abundance will eventually return to preplacement levels at the construction-material ODMDS since it will

be designated for one-time use. Repeated placement of maintenance material at the existing maintenance-material ODMDS will bury benthic organisms and may prevent them from fully developing following placement. However, the site is currently an active ODMDS, thus conditions would not change from existing conditions.

4.14.2.1.4 Artificial Reefs

No artificial reefs are located near enough to the project area such that impacts could be expected with Alternative 2.

4.14.2.2 Essential Fish Habitat

EFH for adult and juvenile brown, white, and pink shrimp, red drum, gag grouper, scamp, red snapper, gray snapper, lane snapper, greater amberjack, king mackerel, Spanish mackerel, and cobia occurs in the project area and includes estuarine emergent wetlands, estuarine mud and sand substrates, estuarine water column, marine water column, and marine nonvegetated bottoms.

Initial placement of dredged material in the construction-material ODMDS would cover benthic organisms with dredged material resulting in a loss of food source. Recovery of some benthic organisms would likely occur relatively quickly, although the assemblage in the dredged material might differ from the assemblage that existed at the PA prior to construction.

As noted in Section 4.9.1.1.1, turbidity is the most obvious impact of dredged material placement. A thorough discussion of turbidity impacts is included in Section 4.9.1.1.1. Material to be dredged is not contaminated and should not pose contamination issues with respect to EFH. In summary, impacts to EFH from turbidity associated with ocean placement are not expected to be significant.

Accidental spills have the potential to impact EFH, and larval and juvenile finfish could be affected significantly should a spill occur. Larval and juvenile finfish tend to be more susceptible to spills than adults and could be affected extensively by a spill during their active immigration periods. Due to their lack of mobility, they are less likely to be able to avoid these areas and could be negatively impacted if a spill were to occur. However, because of increased safety with the wider channels, there should be a slight decrease in the likelihood of oil spill chances with the Alternative 2.

There is no EFH at the beach nourishment site on Quintana. Therefore, there will be no EFH impacts from beach nourishment.

This DEIS will serve to initiate EFH consultation under the Magnuson-Stevens Fishery Conservation and Management Act. The NMFS will review the DEIS and provide comments on EFH impacts.

4.14.3 Alternative 3: Proposed Action with Placement at Surfside

4.14.3.1 Aquatic Communities

Under Alternative 3, impacts to aquatic communities will be the same as those described for Alternative 2.

4.14.3.1.1 Recreational and Commercial Species

Under Alternative 3, impacts to recreational and commercial species will be the same as those described for Alternative 2.

4.14.3.1.2 Oyster Reef Habitat

Under Alternative 3, oyster reef habitat will continue as described in Section 3.14.1.2.

4.14.3.1.3 Offshore Sands

Under Alternative 3, impacts to offshore sands will be the same as those described for Alternative 2.

4.14.3.1.4 Artificial Reefs

Under Alternative 3, artificial reefs will continue as described for Alternative 2.

4.14.3.2 Essential Fish Habitat

Under Alternative 3, impacts to EFH will be the same as those described for Alternative 2.

4.15 ENDANGERED AND THREATENED SPECIES

A Biological Assessment (BA) for this project is being prepared to fulfill the USACE requirements as outlined under Section 7(c) of the ESA of 1973, as amended, and is included in Appendix G. NMFS and FWS will review the BA and will issue a Biological Opinion (BO), if necessary, to ensure that all potential project impacts have been discussed and coordinated with the appropriate agencies during various workgroup meetings.

4.15.1 Alternative 1: No-Action

The No-Action alternative would result in no immediate direct impacts to any endangered plant, terrestrial wildlife, or fish species or endangered species habitat at or near the proposed project area, although some of the habitats may change over time independent of the project. Existing dredging activities and placement of dredged material could result in sedimentation and altered hydrology, which could have an impact on the brown pelican and other birds, although none have been documented. Impacts to sea turtles from ongoing maintenance activities are covered by an existing BO (NMFS, 2003, 2005).

Since there are no Federally protected fish species in the project area (Section 3.15.2.4), Alternative 1 will have no adverse impacts on any endangered or threatened fish. Under Alternative 1, fish species of concern and candidate species will remain as described in Section 3.15.2.4.

4.15.2 Alternative 2: Proposed Action with Placement at Quintana

4.15.2.1 Dredging/Construction Activities

No Federally or State-listed plant species are of potential occurrence in Brazoria County (NDD, 2005; FWS, 2006a). Thus, Alternative 2 would not result in impacts to any endangered or threatened plant species.

The proposed project is unlikely to affect the any endangered and threatened terrestrial species. Many are inland species that are not likely to occur in the affected areas, while others are migrants that pass through the region seasonally. Listed species likely occurring in the project area at some time of the year include the brown pelican, piping plover, reddish egret, and white-faced ibis.

No documented brown pelican nesting sites occur within the project area, although the species may use portions of the project area for foraging, roosting, and loafing. Commercial development and continued dredging and placement of dredged material occurring in the area could result in increased sedimentation and altered hydrology, which could have secondary impacts on the brown pelican by reducing their food source. Such impacts, however, should be temporary and without significant long-term implications and are similar to the No-Action alternative.

Wintering piping plovers are of potential occurrence on beaches and sand and mudflats along the bay margins within the project area. FWS-designated critical habitat for the piping plover (Critical Habitat Unit TX-36) encompasses approximately 388 acres between the mouth of the Brazos River and FM 1495 and includes portions of Bryan Beach and other adjacent beach habitat (66 FR 17; 36142, 10 July 2001). No beach nourishment operations will be conducted within Critical Habitat. The project site is not likely to be an important feeding and resting area for piping plover due to year round human recreational use. Construction activities during the placement of material on the beach may temporarily preclude its use by piping plover for feeding and resting. The duration of the activity would be short and the size of the construction area would not be large enough to cause any significant loss of habitat for the piping plover. The resultant additional beach would provide additional habitat for piping plovers that might use the area. Therefore, the proposed activity may affect, but is not likely to adversely affect piping plovers; no impacts to piping plover critical habitat would occur.

The white-faced ibis and reddish egret likely occur in the general area; however, these species typically inhabit marshes, a habitat that the proposed project is unlikely to affect directly. Dredging activities may indirectly affect these species by reducing the availability of food supplies, particularly if the activities take place during the nesting season. The proposed project is unlikely to have direct effects on any known active rookeries. The decreased potential for chemical or oil spills would reduce impacts to the nekton

community and, thus, the food source of the white-faced ibis and reddish egret. Therefore, the project is not likely to adversely affect the white-faced ibis or reddish egret.

Five species of sea turtles are of potential occurrence in project area waters. The proposed project calls for the use of both pipeline dredges and hopper dredges. It has been well documented that hopper dredging activities occasionally result in sea turtle entrainment and death, even with seasonal dredging windows, v-shaped turtle-deflector dragheads, and concurrent relocation trawling (NMFS, 2003). Between February 1995 and September 2002, hopper dredging activities by the USACE Galveston district resulted in 29 lethal takes of sea turtles: 15 loggerheads, 8 green turtles, and 6 Kemp's ridleys (NMFS, 2003). At Freeport Habor Channel, dredging activities have resulted in the take of 10 sea turtles since 1980: 5 loggerhead sea turtles in 1996, 1 in 1999, and 2 in 2000, and 2 green sea turtles in 2006. Thus, minor impacts to sea turtles could result from mortality associated with dredging activities. Sea turtles easily avoid pipeline dredges due to the slow movement of the dredge. Apart from direct mortality, dredging activities could have an impact on sea turtles through an increase in sedimentation, turbidity, and resuspension of toxic sediments. However, sediments to be dredged have been tested and there is no concern relative to toxicity.

The sedimentation may affect food sources for the turtles, and the turbidity could affect primary productivity. This would be short-term, however, and would be similar to the No-Action alternative. The increased possibility of spills during construction could pose a threat to turtles both directly and indirectly through their food source. While adult sea turtles may be mobile enough to avoid areas of high concentrations, hatchlings, post-hatchlings, and juveniles in the area would be more susceptible. The widened channel is not anticipated to result in an increase in marine traffic, so there should be no higher incidence of collision with sea turtles. Other potential impacts because of the project include disorientation because of lighting on vessels, increased accumulation of plastic detritus, and beach nourishment activities. If sea turtles are present at disposal sites, they may be affected by sedimentation and turbidity. However, all of these conditions exist at present and no significant adverse impacts are expected to sea turtles.

Kemp's ridley sea turtle has been recorded from the project area. In 1994, a headstarted ridley was accidentally caught by an angler on a rod and reel in the GIWW and released alive. This species has also nested in the project area. One nest was found on Quintana Beach in 2002 and another was found near Surfside Beach in 2003 (Yeargan, 2006). If either of these beaches becomes the recipient of beach nourishment activities, the resulting beach may prove to be less attractive to the ridley, or result in a poorer nesting success. Because Kemps' ridley nests during daylight hours, no disorientation for adults from boat lighting would occur. Hatchlings, however, emerge from the nest at night and may be adversely affected by lighting on the boats. Under natural conditions, hatchlings typically take the shortest route to the water's edge. Bright lights on a nearshore hopper dredge may cause the hatchlings to move toward the lights, resulting in a circuitous route to the water or open ocean, thereby exposing them to more danger. While nesting in the study area is uncommon (a maximum of one nest per year), dredging outside of the nesting/emergence season (which occurs between May 1 and October 31), turning off/lowering/shielding

unessential lighting, and use of shielded, low-sodium vapor lights for those that cannot be safely eliminated, would reduce this potential disorientation impact.

As noted above, hopper dredging may also result in mortality of individual Kemps' ridleys. This species is seasonal in nearshore waters of Texas. During the onset of colder waters in December, Kemp's ridley will move away from inshore waters into deeper waters, returning in March with warmer waters, ready to nest on the Texas coast and to forage in tidal passes and bays. Restriction of hopper dredging activities to between December 1 and March 31, whenever possible, would reduce the likelihood of direct mortality. Any dredging activities outside of this timeframe (i.e., between April 1 and November 30) should be with pipeline dredges to reduce mortality. Hopper dredging impacts on sea turtles can also be reduced by having a trawler precede the dredges to capture turtles and relocate them away from the action, which would be required in the dredging contract, as is true for present maintenance dredging. No significant impact to Kemp's ridley because of the project is anticipated.

The loggerhead sea turtle has been recorded from the study area. Between 1995 and 2000, eight loggerheads were caught in Freeport Harbor; and during the Freeport Harbor Project (July 13 to September 24, 2002), one loggerhead was captured by a relocation trawler (NMFS, 2003). The green sea turtle and hawksbill sea turtle are of potential occurrence in the project area. All three species could be negatively impacted by dredging activities. Relocation trawlers working ahead of the dredges would reduce these impacts. No significant impacts to these three species because of the project are anticipated.

Of the five species of sea turtles occurring in Texas waters, the leatherback is the species least likely to be affected by the proposed project because of its rare occurrence and pelagic nature. It is unlikely to occur in the action area and has not been caught in hopper dredges. No impact to this species because of the project is anticipated.

4.15.2.2 Operational Activities

Upon completion of the initial construction dredging activities associated with the project, few impacts are likely beyond those with Alternative 1. Maintenance dredging activities would have similar temporary impacts as the initial dredging, but for a shorter term. The number of vessels in the area is not anticipated to increase or decrease; therefore, the potential for erosion would not change. The possibility of accidental oil or chemical spills would decrease because of safer navigability. Such spills pose a threat to the aquatic community and, thus, the food source for the brown pelican, piping plover, reddish egret, and white-faced ibis. Impacts from noise and human activity are unlikely to be a factor. Impacts to sea turtles would be similar to present maintenance.

Since there are no Federally protected fish species in the project area (Section 3.15.2.4), Alternative 2 will have no adverse impacts on any endangered or threatened fish. Under Alternative 2, fish species of concern and candidate species will remain as described in Section 3.15.2.4.

4.15.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts to endangered and threatened species resulting from dredging/construction and operational activities associated with Alternative 3 would be similar to those associated with Alternative 2, which are discussed in Section 4.15.2.

4.16 CULTURAL RESOURCES

Activities associated with any proposed project have the potential to adversely impact cultural resources through changes in the quality of the archaeological, historical, or cultural characteristics that qualify a property to meet the criteria of eligibility to the NRHP. These impacts occur when an undertaking alters the integrity of location, design, setting, materials, construction, or association that contributes to a resource's significance in accordance with the National Register criteria.

As discussed in 36 CFR 800, adverse impacts on National Register listed or eligible properties may occur under conditions that include, but are not limited to:

1) destruction or alteration of all or part of a property;
2) isolation from or alteration of the property's surrounding environment (setting); or
3) introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.

Impacts may be direct or indirect. Direct impacts are caused by the proposed activities and generally occur concurrently. Indirect impacts include those caused by the activities that occur later in time or are further removed, but are foreseeable. Both direct and indirect impacts may include destruction of a site, alterations in the pattern of land use, changes in population density, or accelerated growth rates, all of which may have an impact on properties of historical, architectural, archaeological, or cultural significance.

The preferred form of mitigation for direct or indirect impacts for cultural resources is avoidance. An alternative form of mitigation of direct impacts can be developed for archaeological and historical sites with the implementation of a program of detailed data retrieval. Additionally, relocation may be possible for some historic structures. Indirect impacts on historical properties and landscapes can be lessened through careful design considerations and landscape.

4.16.1 Alternative 1: No-Action

The No-Action alternative will have no effect on existing or unrecorded terrestrial or nautical cultural resources properties.

4.16.2 Alternative 2: Proposed Action with Placement at Quintana

It is not anticipated that the actions for Alternative 2 for the proposed Freeport Harbor Entrance and Jetty Channels Widening will have any adverse impacts on terrestrial cultural resource sites. The file review did not identify any recorded terrestrial archaeological sites near the area to be dredged or the Quintana beach nourishment site. However, a nautical archaeology survey conducted in March and April of 2005 identified 6 magnetic anomalies within the Freeport Ship Channel that were recommended for additional survey. A close-order survey was performed by PBS&J in February 2006 as a means to further identify these targets (Borgens et al., 2006). Two magnetic anomalies within the Freeport Ship Channel have features indicative of submerged shipwreck sites. Cartographic research suggests that an additional four anomalies could be associated with submerged portions of the historic Velasco townsite. These six anomalies are within the project footprint, would be affected by modifications to the channel, and have been recommended by THC for diver assessment and/or probing by qualified nautical archeolgoists selected by the Applicant prior to project construction.

4.16.3 Alternative 3: Proposed Action with Placement at Surfside

The file review did not identify any recorded terrestrial archaeological sites near the area to be dredged or the Surfside beach nourishment site. It is not anticipated that the actions for Alternative 3 for the proposed Freeport Harbor Entrance and Jetty Channels Widening will have any adverse impacts on terrestrial cultural resource sites. Impacts to marine sites would be the same as for Alternative 2.

Known shipwrecks or potential shipwreck sites also must be considered in an impact assessment. Even though a survey was recorded in the proposed Surfside beach nourishment site, this survey was conducted in the 1970s and less reliable technology was available at that time. Areas near the shore potentially holding known shipwrecks, as discovered in the THC and Automated Wreck and Obstruction Information System (AWOIS) searches, may be impacted by the proposed beach nourishment.

4.17 LAND USE/RECREATION/AESTHETICS

4.17.1 Alternative 1: No-Action

Under the No-Action alternative, the study area (Brazoria County) would continue on its present course of moderate population growth, and of fairly rapid commercial, residential, and industrial land development. The Port of Freeport would continue to function as an important port because of its industrial facilities and international commerce. The Port of Freeport would also continue to develop its industrial properties, but at a slower rate than it would with the proposed action. Many developments would not be built in the proposed location without the widening of the Freeport Harbor Channel. Without the channel widening, safety concerns related to large vessels would continue, as would delays. In addition, without the proposed action, future transportation projects such as improvements to existing roadways, as well as construction of new roadways, may be cancelled or delayed.

No impacts to transportation, community services, aesthetics, or future developments would occur with the No-Action alternative.

4.17.2 Alternative 2: Proposed Action with Placement at Quintana

4.17.2.1 Land Use

The proposed action would not affect any shoreline land uses; therefore, would have a minimal impact on land use. All channel improvements would occur in open-water locations. The only land use implications for the proposed action relate to proposed BU site placement of 300,000 cy of silty-sand on Quintana Beach to protect the Seaway PA from failure due to erosion and indirect future land development that may occur as a result of the proposed project.

The greatest long-term land use consequence of the proposed action would be indirect and would likely be a change in future land uses that could occur in response to the improvements to the channel. These future land uses are speculative and are, therefore, not considered part of the proposed project, but would be less likely to occur without it. The Port of Freeport currently owns property along the Freeport Channel, which is available for development for industrial sites. When the proposed action is completed, the Port would have a wider ship channel providing an incentive for new industrial development at all of the Port properties, based on navigation cost savings. Future industrial development may include oil and gas refineries, petrochemical plants, and bulk grain facilities. The long-term land use effects of these industrial facilities are largely unknown; however, they could lead to an increase in demand for new housing development, new roads, commercial services, schools, and other services within Brazoria County.

4.17.2.2 Transportation

In response to Alternative 2, the existing transportation system within the project area could be temporarily affected by the influx of construction workers and the delivery of construction equipment and materials to the project area. During widening activities, approximately one truck or van for each of the three dredge units would make two round trips from Freeport to a transfer point near the channel for approximately 310 days (Wagner, 2006). The addition of these few employees accessing the project area on a daily basis would not result in a significant increase in volume that would adversely affect traffic on area roadways.

4.17.2.3 Community Services

The proposed action would result in minor temporary or no impacts to local community facilities and services such as police, fire, medical, and waste disposal services. Local communities have adequate infrastructure and community services to meet the needs of the nonlocal workers that would be required for the proposed project. Other construction-related demands on community services could include an

increase in police enforcement and emergency medical services to treat injuries resulting from construction activities.

The proposed action would not affect the delivery of local services, including water, wastewater, or other utilities. No disruption to roads or rail transportation would result from the proposed action. The proposed widening would result in only minor changes in traffic demand on local roads and highways and would not affect the delivery and quality of local services to the population living within the vicinity of the project area. Therefore, Alternative 2 would not result in significant impacts on community services in the project area.

4.17.2.4 Aesthetics

Alternative 2 would have a minimal effect on the overall visual quality within the project area. There would be no significant effect to the appearance of the shorelines that are adjacent to the proposed channel improvements. The project area includes a variety of land uses, including shoreline residential development, commercial development, public and private marinas, parkland, relatively undisturbed natural areas, fishing and tourism-related businesses, civic uses, transportation systems (highways and railways), port facilities, and heavy-industry areas. The only aspects of the proposed action that would affect the visual quality of the study area would be the beach nourishment area. This includes the placement of approximately 300,000 cy of silty sand material dredged from the Jetty Channel on Quintana Beach in front of the Seaway PA. The shoreline areas closest to the Seaway PA are existing public facilities, undeveloped land, and a few residences. The beach nourishment area was requested by the residents and would be visible looking southeast from homes and the Quintana Beach County Park.

4.17.2.5 Future Development and Development Restrictions

The proposed action is compatible with existing and proposed zoning adjacent to the project area. Improvements would neither constrict the future development of planned land uses by local jurisdictions nor inhibit the densification of uses within the project area.

The proposed action supports current local land use objectives for property adjacent to the project area and is consistent with long-range plans to increase cargo capacity into the Port of Freeport. Because the proposed project would not affect any shoreline land uses, it would not require changes in local agency zoning codes or site-specific zoning.

4.17.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2 except the proposed BU site placement of 300,000 cy of dredged material would be on Surfside Beach to provide additional beach in front of several beachfront homes. The beach nourishment area was requested by area residents as a protective measure against erosion. This area would be visible looking southeast from homes along the beachfront.

4.18 SOCIOECONOMICS

4.18.1 Population

4.18.1.1 Alternative 1: No-Action

The No-Action alternative would not relocate businesses, homes, or any other properties, nor would it change population growth trends or development patterns within the study area. Demand for community facilities, services, and housing would increase in response to the projected population growth. The locations of these resources would generally follow development and land use plans identified by the City of Freeport, Quintana, Surfside Beach, and Brazoria County. This alternative would not result in potentially significant impacts.

4.18.1.2 Alternative 2: Proposed Action with Placement at Quintana

The proposed action would not affect any shoreline land uses; therefore, would require no business or residential relocations. This alternative would neither divide nor isolate any particular neighborhood nor separate residents from community facilities.

The proposed action would likely have a negligible effect on population growth trends within Brazoria County. Population in this county is projected to grow at a rapid rate of 78% between 2000 and 2040, regardless of the proposed project. As a result of the proposed action, demand for community facilities, services, and housing would increase at a rate that is consistent with the projected population growth. The location of these resources would generally follow development and land use plans currently identified. Most of the construction workers are likely to come from the labor force that is already living within Brazoria County and if not, the number of these workers is small and their stay would be temporary. Therefore, immigration to Brazoria County area would be fairly minimal. This alternative would not result in potentially significant impacts.

4.18.1.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2.

4.18.2 Employment

4.18.2.1 Alternative 1: No-Action

The No-Action alternative would have a negligible effect on the local economy within the project area and within Brazoria County. It would not change the number of employed persons nor industry trends. Employment would increase in response to the projected population growth. This alternative would not result in potentially significant impacts.

4.18.2.2 Alternative 2: Proposed Action with Placement at Quintana

All dredging construction work would be performed over a one-year period beginning in late 2007. Indirect and induced employment would occur within Brazoria County as dredge workers spend some of their disposable income locally, and as operation of the dredges would necessitate expenditures on fuel, which would be purchased from firms located in Brazoria County.

The industries that would benefit directly (in terms of employment) from the proposed project during the construction and O&M phases would be dredging contractors and other construction contractors that would be involved in nondredging activities. When the proposed project is completed, it is likely that new industrial development would occur within the Freeport Harbor. The widened ship channel would provide an additional benefit to industry, which would likely attract new companies to locate within the Freeport area. With the widened channel in place, it would be more likely that new petrochemical plants, bulk grain facilities, petroleum, and natural gas refineries would be built within the area. The impact of these new industries on employment within Brazoria County is unknown, but could potentially be substantial. The potential increase in employment may increase the rate of immigration, the demand for housing, schools, and other services within Brazoria County. As a result of the increased immigration of workers, it is likely that an increase in single-family homes would occur in Brazoria County (within and near the cities of Freeport, Oyster Creek, Quintana, and Surfside Beach) where vacant land is available for such development and is located near such available industrial sites.

During the proposed project construction, the City of Freeport, Quintana, Surfside Beach, and Brazoria County would have an increase in employment and local purchases of construction materials. As construction dollars are spent locally, there would be a beneficial effect on local employment in the area. The proposed project would not result in potentially significant impacts.

4.18.2.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2.

4.18.3 Economics

4.18.3.1 Alternative 1: No-Action

Without the proposed action, the Freeport area would continue on its present course of economic development and diversification, of moderate population, and commercial, residential, and industrial land development. The Port of Freeport would continue to function as an important port for its industrial facilities and international commerce. However, the Port of Freeport would also continue to develop its industrial properties but at a slower rate than it would with the proposed action. Crude petroleum imports have increased in the U.S. in response to both increases in demand and decreases in domestic production. Petroleum imports are and have been the major form of waterborne commerce at the Port of Freeport (USACE, 2002). The maximum dimensions for the very large crude carriers (VLCC) are 900–1,500 ft

length all over (LOA), 160–250 ft beam, and drafts of 60–80 ft. The shuttle tankers are typically 800 ft LOA, 140 ft beam, and maximum drafts exceeding 46 ft. Typically, it takes three partially loaded shuttle tanker runs to transport the oil from the VLCC because of the 45-ft draft limitation. The trend is towards larger vessels and without the proposed project the Port of Freeport may lose income due to time delays and added costs of having to use shuttle tankers.

The No-Action alternative would have a negligible effect on the local economy within the project area and within Brazoria County. Because no property would be removed from the tax rolls, the tax base would not be affected. It would not change the number of employed persons nor industry trends. This alternative would not result in potentially significant impacts.

4.18.3.2 Alternative 2: Proposed Action with Placement at Quintana

As the channel is widened from 400 to 600 ft, two-way traffic will be allowed on the channel, which will reduce vessel delay times for all vessels and barges transiting the Freeport Ship Channel. As a result, vessels will no longer be restricted to 120,000 DWT. The resulting total annual NED economic benefits of the proposed widening due to time savings would be $487,415 (Martin Associates, 2006).

As previously discussed, the primary economic bases of the county include chemical manufacturing, petroleum processing, offshore production maintenance services, biochemical and electronic industries, commercial fishing, and agriculture. As a result of the proposed project, the positive economic effects to the Brazoria County economy could be substantial.

4.18.3.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2.

4.18.4 Environmental Justice

4.18.4.1 Alternative 1: No-Action

The No-Action alternative would result in negligible effects to the City of Freeport, Quintana, Surfside Beach, and Brazoria County. Similarly, no particular social group would be affected. The effects of this alternative on minority and low-income persons living within the project area are negligible.

4.18.4.2 Alternative 2: Proposed Action with Placement at Quintana

The population living within the vicinity of the proposed alternative was predominately white with the exception of the City of Freeport, with only 33% of the population being white. In general, the effects of this alternative on minority or other identifiable groups living within the project area are expected to be negligible because there would be no physical changes to the environment or land use.

Because there would be no physical changes to the environment or land use, minority and low-income populations living within the project area would experience no adverse changes to the demographic,

economic, or community cohesion characteristics within their neighborhoods as a result of the proposed project. Generally speaking, the population living within these block groups would benefit from the proposed project. These benefits would include minimal short-term local employment in which a portion of the project wages would find their way into the local economy, benefiting local populations. Therefore, the proposed project would not result in disproportionately high and adverse impacts on minority and low-income persons living within the project area.

4.18.4.3 Alternative 3: Proposed Action with Placement at Surfside

Impacts associated with Alternative 3 are expected to be the same as described for Alternative 2.

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